Southeast Dairy Producer's Check-Off Program

Research Summary

Soil Organic Carbon Sequestration in Florida Dairies

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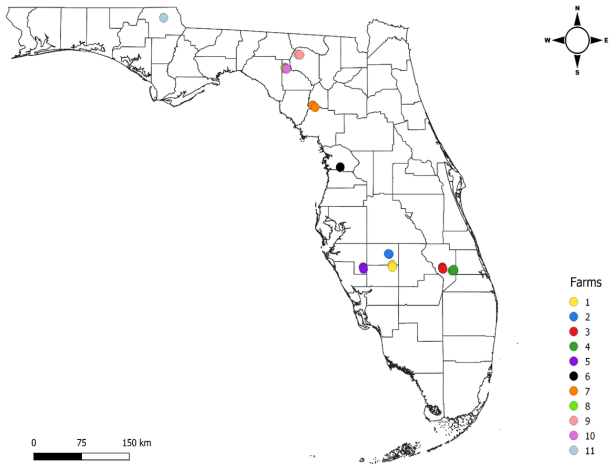
Implications

Florida has approximately 80,000 acres of corn crop and 280,000 acres of hay fields and a large portion of that is dedicated to forage production by the dairy industry. If we assume an average of 58.3 short tons (2,000 lb) per acre and we consider 360,000 acres, this represents a carbon stock of 21 million tons of carbon stored in the soil from 0 to 36". This is an important ecosystem services provided by FL dairies to the entire society.



Methods

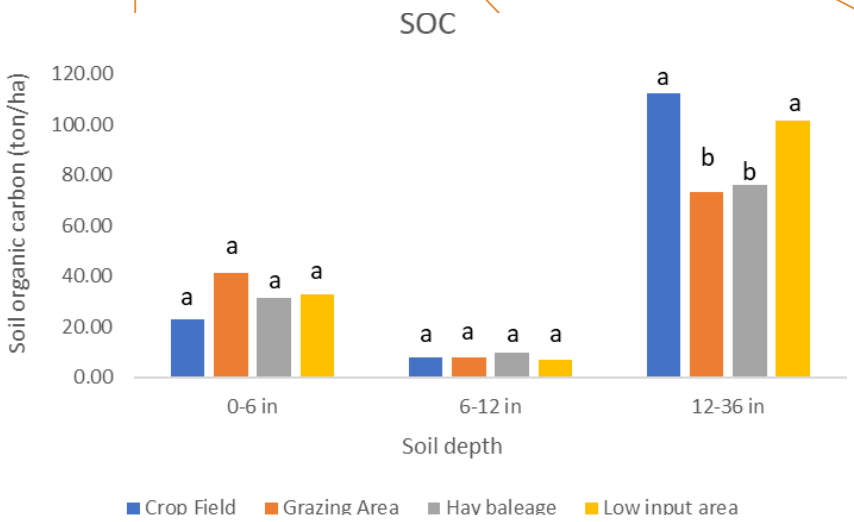
We collected soil samples from 11 Florida Dairy sites across the State of Florida (Figure 1). Farm selection was based on geographical location and willingness of the dairy producer to participate in the project. We selected farms representing North, Central, and South Florida. Within each farm, we collected samples from the following land uses: cropping fields (e.g., corn, sorghum, millet), hay and/or baleage fields with perennial grasses (e.g., bermudagrass, limpograss, bahiagrass), grazing areas, and native vegetation and/or areas with less manage/inputs. On each land use type, we collected a composite sample formed by 20 subsamples using a random transect in a representative area of the field. Soil samples were collected down to 3 ft. depth, at the following soil layers: 0- to 6-, 6- to 12-, 12- to 36-inch layers. Soil cores were used to determine soil bulk density to estimate soil organic carbon stock. In addition, soil texture of each site was determined within each layer. Soil organic C was determined after acid fumigation to remove carbonates prior to total organic carbon analyzes (Harris et al., 2001). Soil samples from each layer was ball milled in a Mixer Mill MM 400 (Retsch) for 9 min at 25 Hz and analyzed for total carbon using a CHNS analyzer (Vario Micro Cube) and the Dumas combustion method. Soil carbon stock of each land-use type within each farm was estimated by using soil bulk density and soil organic C concentration within each soil layer. Each farm was considered a block. Therefore, we had four land use types as treatments and

11 blocks (each farm was block). Within each farm, we kept the sites as uniform as possible in terms of soil type using web soil survey from USDA. Statistical analyzes were performed using proc mixed from SAS where land use type was considered a fixed effect and farm site a random effect. Soil layers were considered repeated measure in space. We analyzed SOC stocks and fertility down to the entire soil profile and by layer.

Results

Soil organic carbon

Total soil organic carbon (SOC) differed across soil layers and there was an interaction between land-use type and soil layer (Figure 2). At the top layers (0-6 and 6-12 inches) there were no difference within layer for land use type, but with greater SOC stock in the top 6 inches. The bottom layer (12 to 36") had greater stock of SOC, but it is also four times deeper than the top two layers. At the bottom layer, there was greater SOC for the crop field and low input areas. The total SOC of all layers together averaged 131 t C/ha, which is a very significant amount, and it was not different across land use types within each dairy (Figure 3). This data indicates the importance of FL Dairies sequestering carbon and providing this important ecosystem service for the society.



Soil fertility

There were differences among land uses regarding soil fertility. Fields under effluent irrigation (hay/baleage) typically had better soil fertility compared to other areas in the farm. This also demonstrates another important ecosystem service of the dairies by recycling nutrients back to production fields and adding them to the production system while saving on fertilizer costs and reducing carbon emissions related to fertilizer manufacturing. Soil layer also affected the fertility. Overall, the top layer had greater concentration of soil nutrients and soil organic matter. Potassium tended to be better distributed along the soil profile, likely because it is more soluble than P and other nutrients. This also reinforces the need to replenish soil K more frequently in FL sandy soils, especially in harvesting systems, where the K extraction is greater than in grazing conditions.

Take Home Messages

Florida dairies stock on average 131 tons of soil organic carbon per ha from 0 to 36"deep (58.3 short tons/acre; 1 short ton = 2,000 lb). This is an important ecosystem service provided to the entire society. Furthermore, FL dairies recycle back nutrients to their field, improving nutrient cycling and reducing the use of industrial fertilizers, reducing the carbon footprint of their operations. Land use types within each dairy was not significantly different for most of the cases when it comes to soil organic carbon, except for the bottom layer (12 to 36") when some differences were observed. It is important to sample more dairy fields to improve the dataset, bringing more statistical power for the analyses.